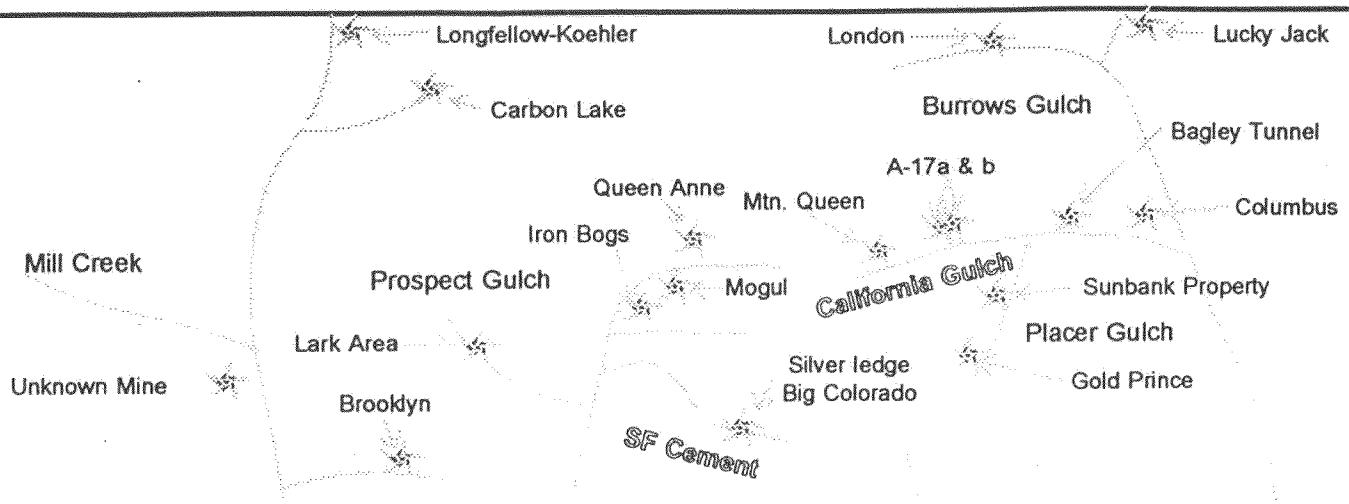
Upper Animas Watershed

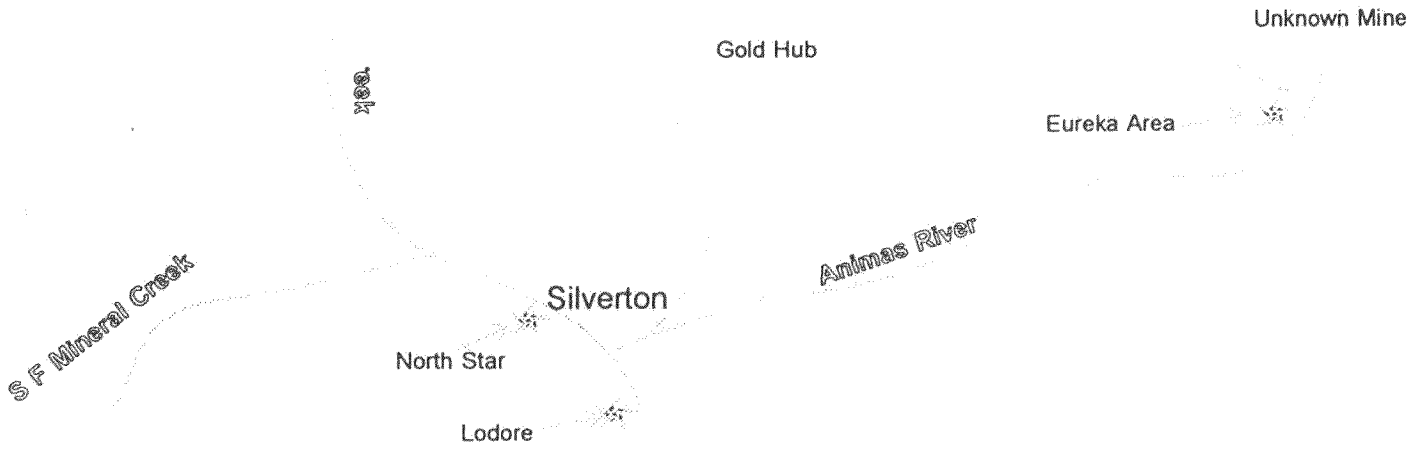
3/1/1995

Preliminary Assessment - PASI Sites - PA/SI Watershed - Reconaissance Feasibility Investigation Report - Upper Animas River Basin



RECONAISSANCE FEASIBILITY INVESTIGATION REPORT

UPPER ANIMAS RIVER BASIN



Jim Herron, Bruce Stover, Paul Krabacher and Dave Bucknam

Colorado Division of Minerals and Geology

March, 1995

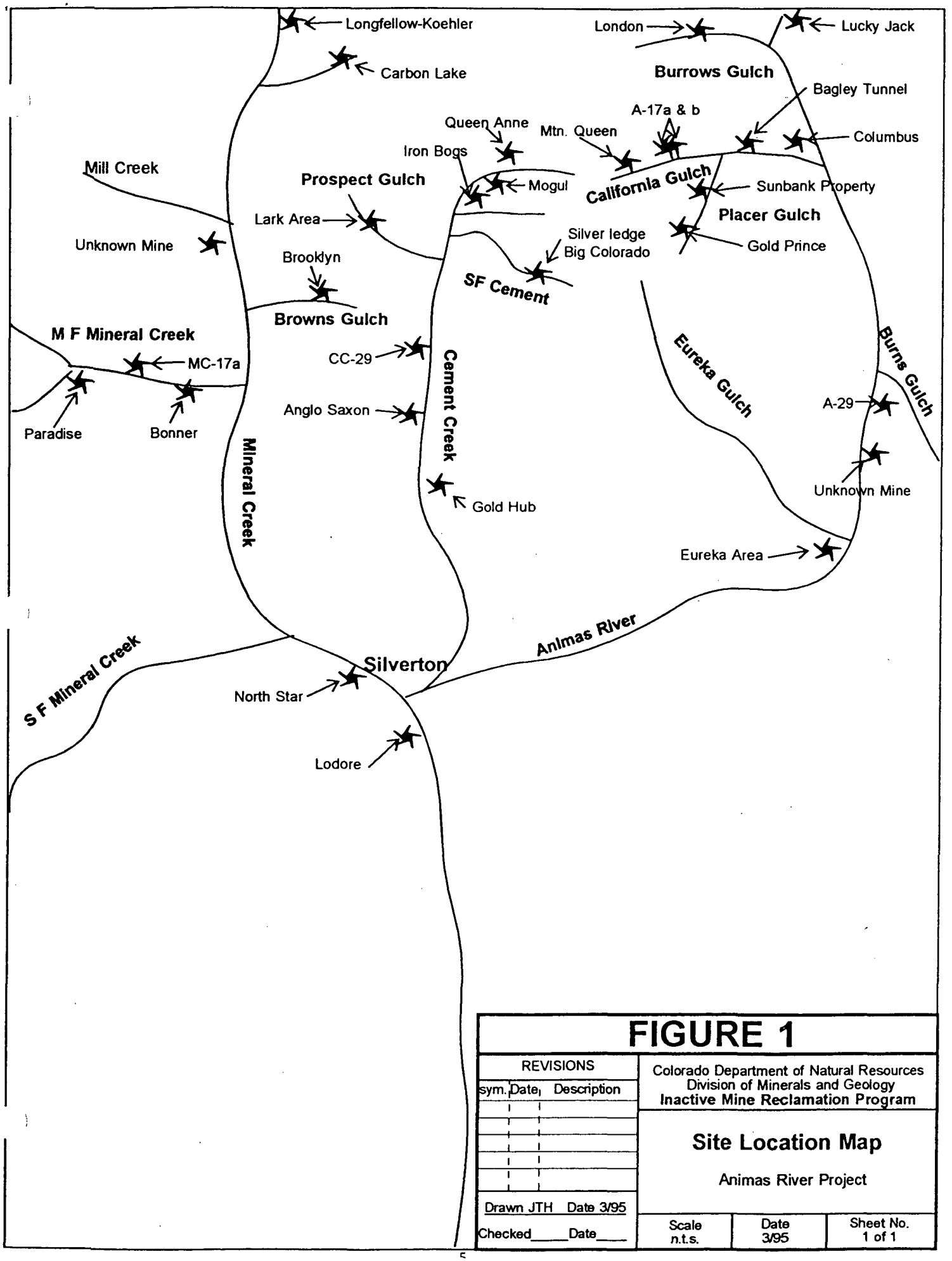


FIGURE 1

REVISIONS		
sym.	Date	Description

Drawn JTH Date 3/95

Checked____ Date____

Colorado Department of Natural Resources
Division of Minerals and Geology
Inactive Mine Reclamation Program

Site Location Map

Animas River Project

Scale	Date	Sheet No.
n.t.s.	3/95	1 of 1

Cement Creek Watershed

Queen Anne Mine

This site is a draining mine above sampling site CC-1. The mine drainage infiltrates into the mine dump and emits as a spring at the base (Figure 9). Based upon a June, 1992 site visit, it appeared that the water quality degraded as the mine drainage flowed through the waste pile. The possible remedial measures for this site are to divert the drainage from the adit into a small settling pond for approximately $10,000 and/or construct an anoxic limestone drain in the adit for an additional $40,000.

Additional monitoring should be done at this site.

Unknown Mine in Ross Basin (Sampling Site CC-1c)

This mine is located directly south of the Queen Anne Mine in lower Ross Basin above the confluence of the tributary receiving drainage from the Queen Anne Mine. In July, 1993, acid drainage was observed flowing from the base of the waste rock pile. The adit was totally covered with snow, so the source of the drainage could not be ascertained. If the source is from the adit, the drainage should, at a minimum, be conveyed around the pile. The pH in July, 1993 was measured at 3.7. There was iron precipitate observed in the drainage channel and a white precipitate in the stream below the confluence with the stream. This site needs to be investigated further to determine whether any remedial measures are warranted.

Moqul Mine (Sampling Site CC-1b)

This mine site is located on Cement Creek below the Queen Anne Mine and the Unknown Mine discussed above. The adit was observed to be draining approximately 5 gallons per minute in July, 1993, but there was visual evidence that higher flows commonly occur. The pH 3.1 mine drainage flows approximately 75 feet over the waste rock pile, then disappears into the waste pile (Figure 10). The drainage reappears at the toe of the waste rock pile in numerous locations. Additional characterization needs to be done at this mine site to determine whether any remedial measures are warranted. At a minimum, the mine drainage should be conveyed around the waste rock pile to prevent additional metals contamination.

Iron Bogs Between Sampling Sites CC-2 and CC-3

This site includes two old iron bogs that have been denuded by drainage off of adjacent mine waste piles. The northern denuded area is estimated to be 2.5 acres in extent. The southern denuded area is estimated to be 4 acres in size. The water draining from these denuded areas had a pH of 3.4 in June, 1992.

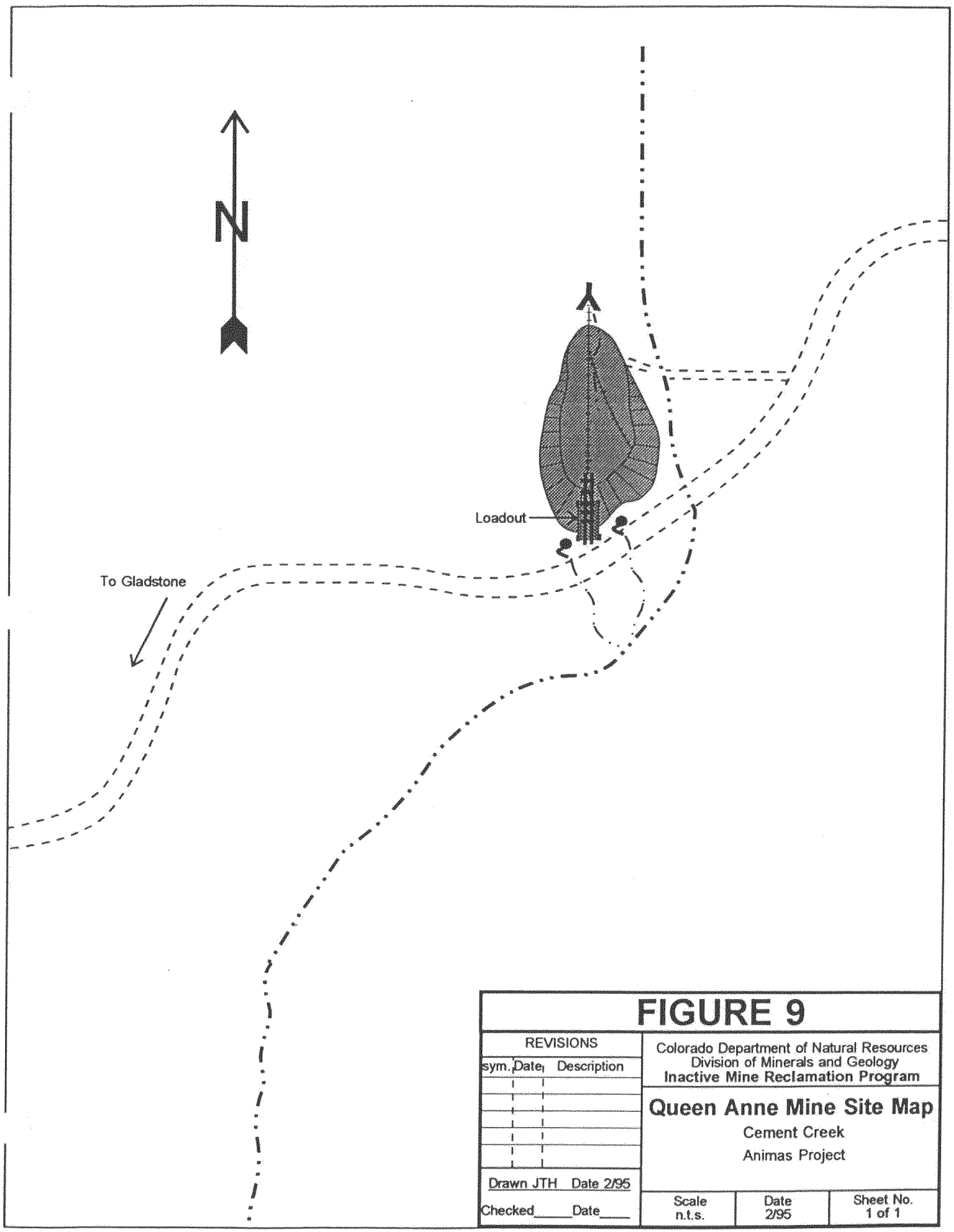


FIGURE 9

REVISIONS			Colorado Department of Natural Resources Division of Minerals and Geology Inactive Mine Reclamation Program		
sym.	Date	Description	**Queen Anne Mine Site Map** Cement Creek Animas Project		
Drawn JTH Date 2/95			Scale n.t.s.	Date 2/95	Sheet No. 1 of 1
Checked_____Date____					

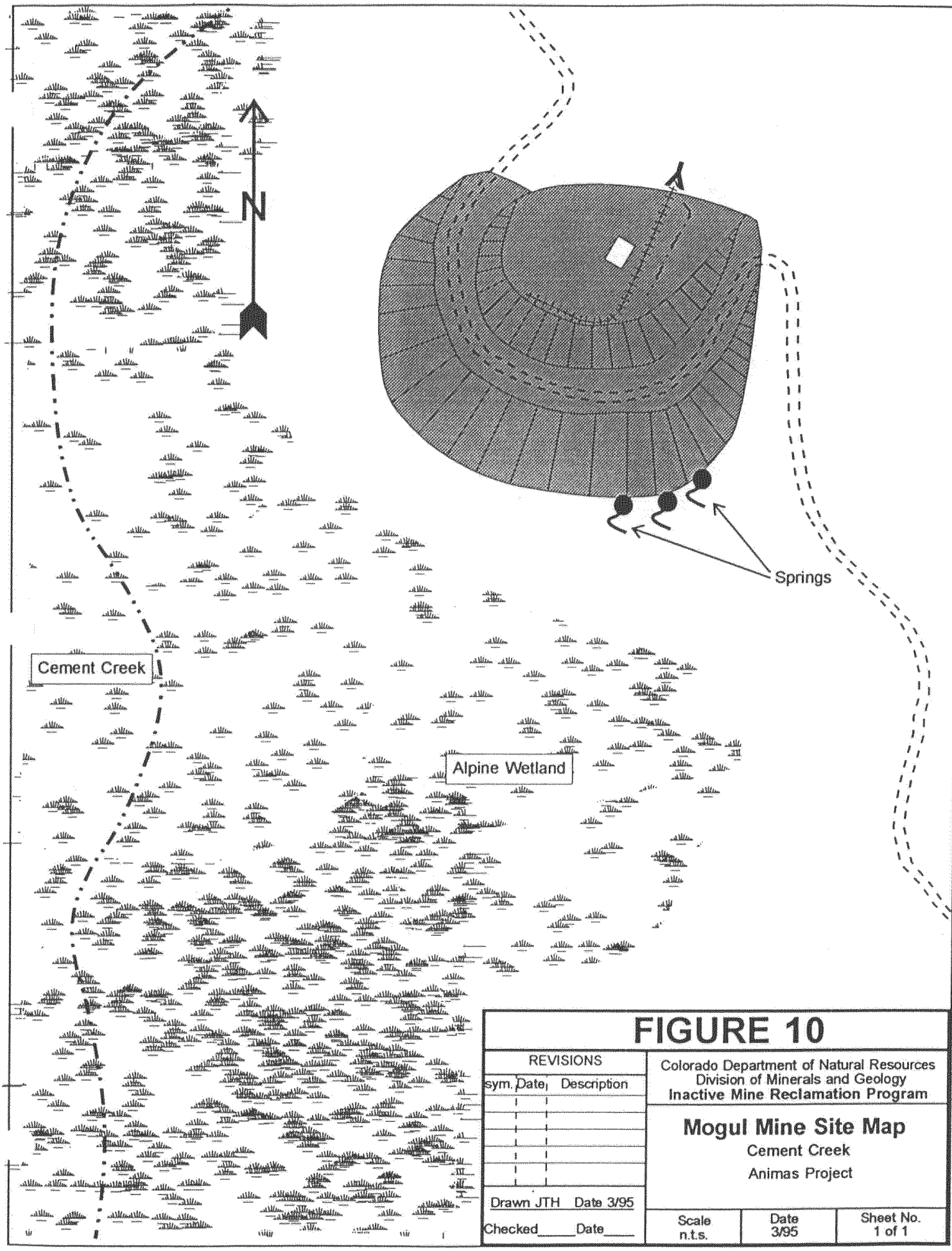


FIGURE 10

REVISIONS		
sym.	Date	Description

Drawn JTH Date 3/95

Checked_____Date_____

Colorado Department of Natural Resources
Division of Minerals and Geology
Inactive Mine Reclamation Program

Mogul Mine Site Map

Cement Creek

Animas Project

Scale	Date	Sheet No.
n.t.s.	3/95	1 of 1

It is thought that the iron bogs were denuded by the acidified runoff from the adjacent mine waste rock piles. This resulted in weathering of the precipitated sulfides, releasing metals to Cement Creek.

The preferred remedial measures and costs include:

1)	Diverting run-on water around the waste rock piles	$ 4,000
2)	Regrade area	$ 8,000
3)	Apply limestone to denuded areas (estimated 10 T/A)	$13,000
4)	Apply compost or other growth media (5,200 C.Y.)	$95,000
5)	Revegetation	$ 4,875
6)	Project Management	$ 7,000
TOTAL		$131,875

Upper Gold King Mine (North Fork)

Due to access problems, this site was not visited. However, based upon the water quality samples taken on the North Fork above the confluence with Cement Creek, and visual observations in 1992 and 1993, this drainage appears to be a major contributor of metals. This site should be investigated further to determine what potential remedial measures are available.

Silver Ledge and Big Colorado Mines (South Fork)

The Silver Ledge and Big Colorado Mines are located on opposite sides of the South Fork of Cement Creek (Figure 11). The Silver ledge mine was observed, in June, 1992, to be draining approximately 250 gallons per minute of pH 6.6 water. The water is obviously heavily laden with iron.

The Big Colorado mine was not observed to be draining, but is below one avalanche path and another avalanche chute is located on the western side of the waste rock pile. It appeared that the avalanche chute above the mine does not commonly run onto the waste rock pile. However, the drainage from the collected snow does flow onto the waste rock pile.

The preferred remedial measures include diverting the drainage around the Big Colorado waste rock pile, and constructing an aeration/settling pond below the Silver Ledge mine. The settling pond will allow precipitation of suspended iron and potentially co-precipitate other metals. The estimated cost of this is $23,000.

Additional work could be done at this site at a much greater cost relative to the amount of metal reduction. The Big Colorado waste rock pile could be moved to a drier location and revegetated. The drainage from the Silver Ledge could be treated by constructing a oxidation wetland, neutralization system, or sulfate reducing wetland.

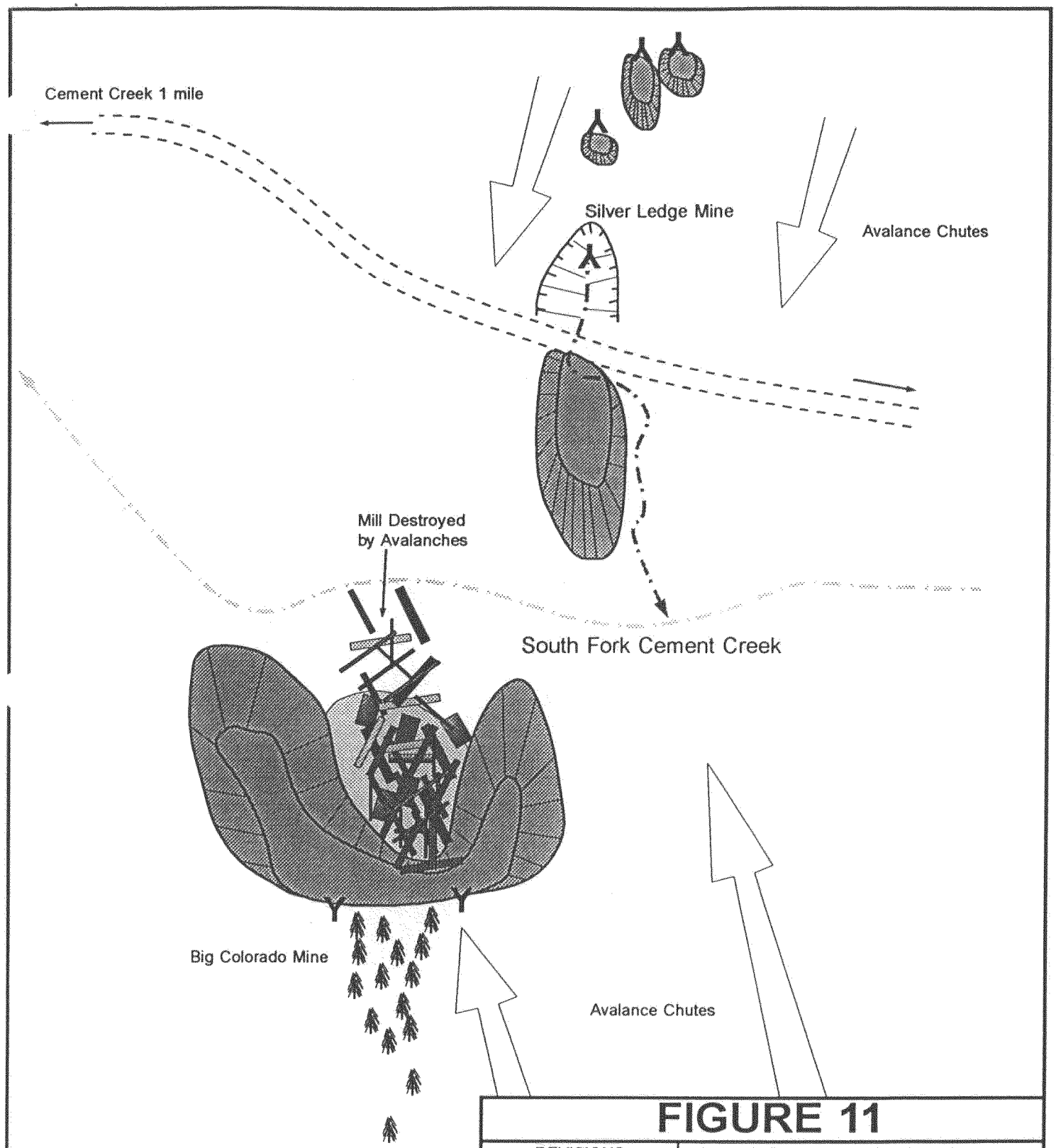


FIGURE 11

REVISIONS			Colorado Department of Natural Resources Division of Minerals and Geology **Inactive Mine Reclamation Program**		
sym.	Date	Description	**BIG COLORADO AND SILVER LEDGE MINE SITE MAP** South Fork, Cement Creek Animas Project		
Drawn BKS Date 3/95					
Checked_____Date____			Scale as shown	Date 3/95	Sheet No. 1 of 1

Lark Mine Area (Prospect Gulch)

This site consists of three separate mines owned by Henrietta Mining Company, and at least three other mine sites not visited. This area needs to be monitored more intensively to determine the metals contribution from each of the three mines. It was observed in a June, 1992 visit that the Lark Mine and the mine south of the Lark were draining (Figure 12). The drainage from each of these mines was observed to infiltrate into the waste rock piles and enter the creek as seeps at numerous locations. The upper Lark was not draining, but a shaft was observed to have swirling water at 50 feet below the surface. Also, runoff from above the mine was observed to flow through several waste piles and had denuded a large area below the waste piles.

Based upon the June, 1992 inspection of the site, the most appropriate remediation would be to remove the mine waste rock in and adjacent to the stream channel, and construct a series of run-on and run-off diversions and ponds. The estimated cost of this construction is $80,000.

One other potential method of reducing metals from this mine area is to construct anoxic limestone drains and settling ponds at the two draining mines. This is estimated to add an additional $80,000 to the construction cost.

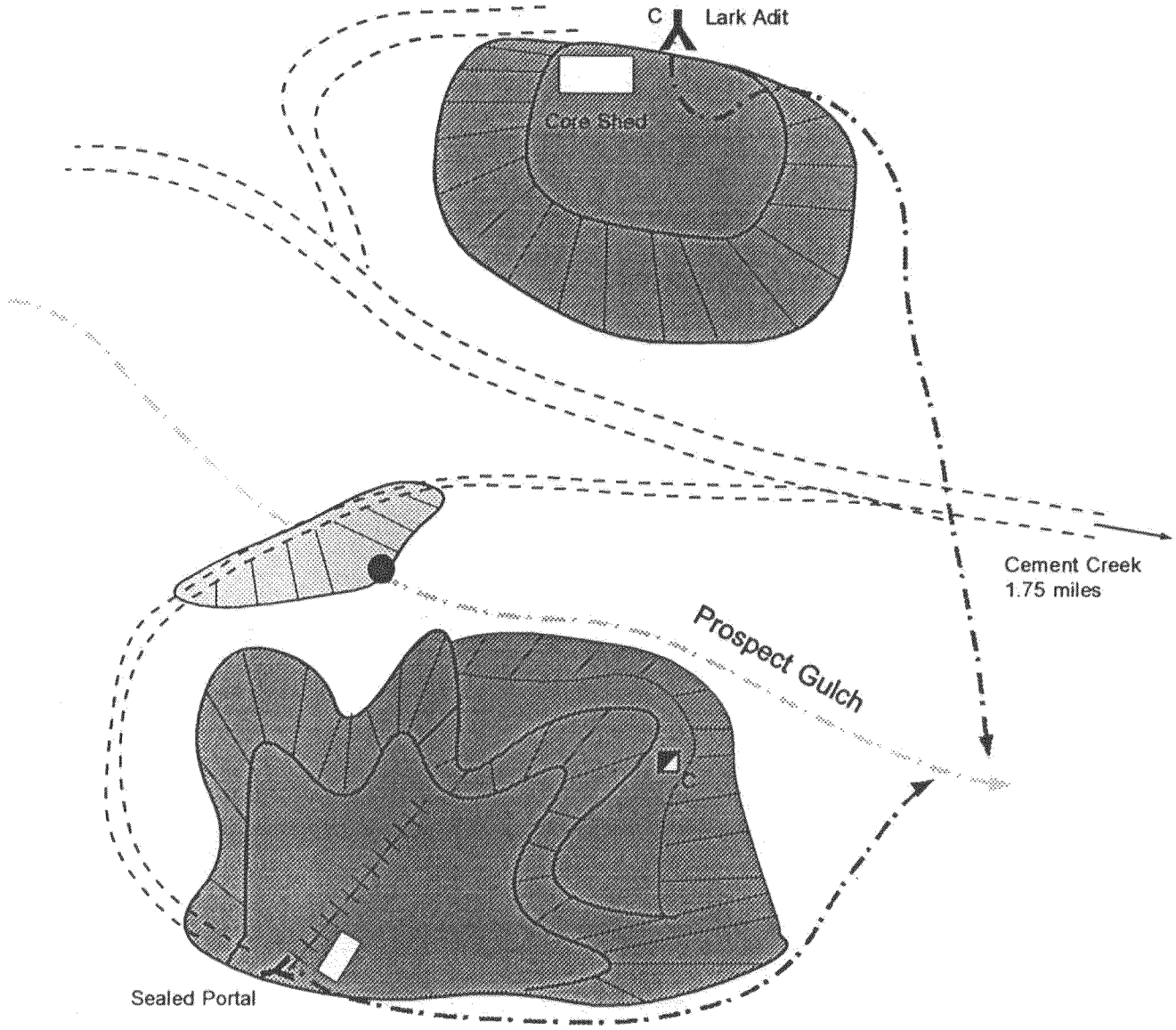
Additional investigations should start with a thorough reconnaissance of the entire Prospect Gulch watershed. As previously stated there are at least three mine sites not investigated. Two are downstream of the mine sites shown in Figure 12 and one is in the upper basin. At a minimum, the draining mines should be sampled and there should be tight bracketing of stream samples to determine the metals contribution from the waste rock piles

Unknown Mine at Sampling Site CC-29

A draining mine adit at this site flows across the mine waste rock pile into Cement Creek. It appears that considerable metals precipitate as the drainage flows to Cement Creek. Although this is not a significant source of metals, diverting the mine drainage around the waste rock pile and constructing a settling pond could precipitate a portion of the metals. The estimated cost of this construction is $20,000.

Anglo Saxon Mine

The Anglo Saxon mine has a draining adit which flows over the waste rock pile into a small settling pond then into Cement Creek. A spring at the toe of the waste pile also flows perennially. The settling pond is evidently maintained by the property owner. The site was visited in June and October 1992. In October, it was observed that the banks of the settling pond had been built-up. The settling pond is trapping considerable amounts of metals.



N

Scale: 1"= approx. 100 '

FIGURE 12

REVISIONS		
sym.	Date	Description

Drawn BKS Date 3/95

Checked_____Date____

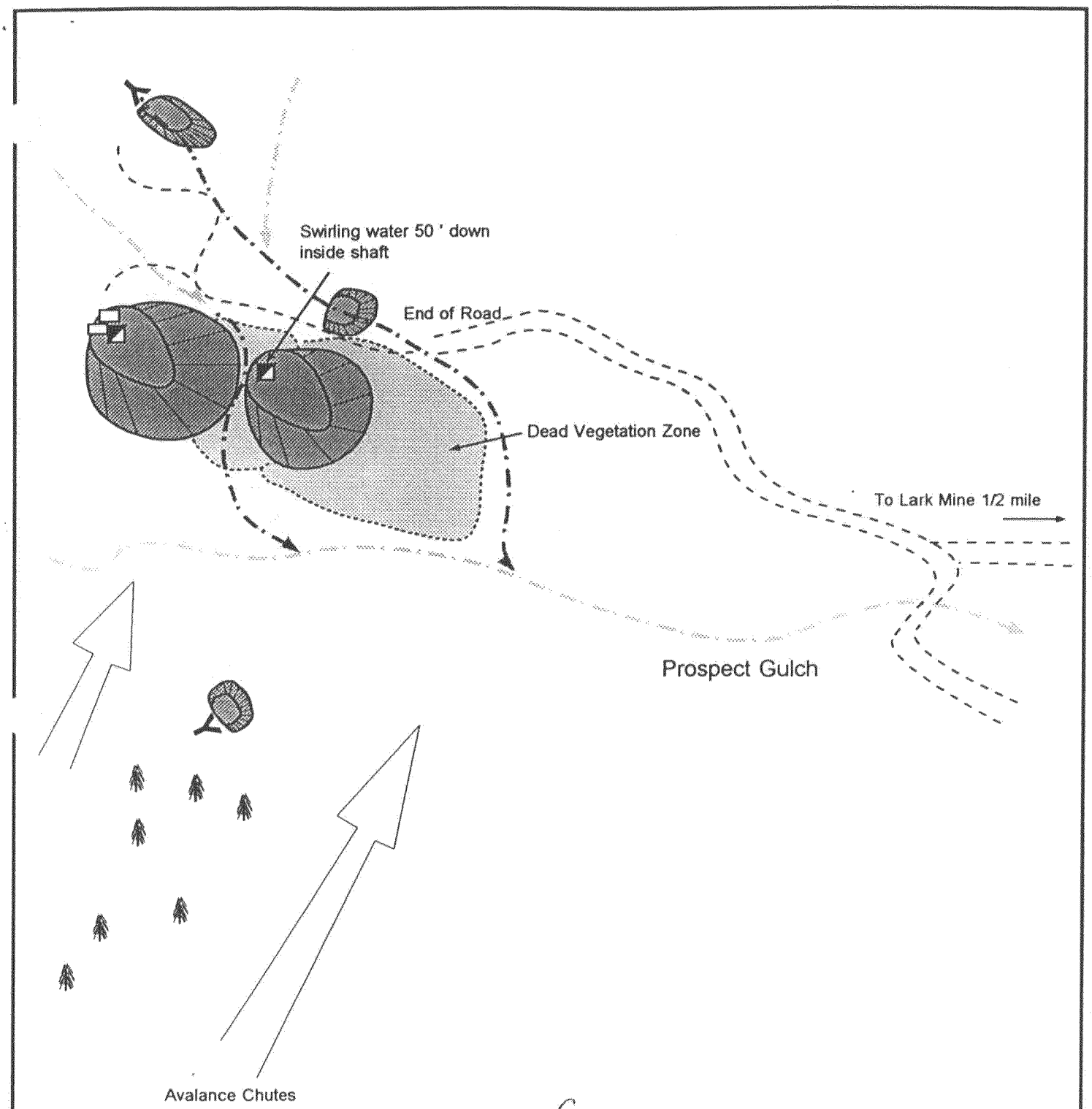
Colorado Department of Natural Resources
Division of Minerals and Geology
Inactive Mine Reclamation Program

LARK MINE, PROSPECT GULCH

Cement Creek

Animas Project

Scale	Date	Sheet No.
as shown	3/95	1 of 2



Galena Queen?

FIGURE 12

REVISIONS			Colorado Department of Natural Resources Division of Minerals and Geology **Inactive Mine Reclamation Program**		
sym.	Date	Description	**UPPER LARK SHAFTS SITE MAP** Prospect Gulch, Cement Creek Animas Project		
Drawn BKS Date 3/95					
Checked_____Date____			Scale as shown	Date 3/95	Sheet No. 2 of 2

The preferred remediation for this site is to divert the mine drainage around the waste pile. It is believed that this will stop the flow of the spring at the base of the waste rock pile. Below the diversion structure, a larger pond would be constructed to settle out some of the metals. The estimated cost of this construction is $14,000.

Gold Hub Mine (Yukon Mill)

This is an active mining site and appears to be contributing very little heavy metals to Cement Creek. No action is recommended for this site.

Summary

Several mining sites in the Cement Creek drainage that appear to be significant sources of heavy metals need to be further characterized. These include the Gold King mine, Mogul mine and an unknown mine below the Queen Anne mine in Ross Basin.

Based upon visits to Cement Creek in 1992, 1993, and 1994 there are some obvious hydrologic control methods that could be constructed that should result in a significant reduction of metals at a relatively low cost. The available water quality information, background study information and visual observations indicate that Cement Creek would remain a aquatically dead stream even if all the mining impacts were eliminated. However, metals reduction in Cement Creek will improve the water quality in the Animas River below the confluence with Cement Creek